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Peony Growing

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PEONY GROWING

A. M. S. Pridham

The attractive color for mass or accent and the clean, cool, green foliage make the peony a particularly interesting garden flower. Its hardiness, its comparative ease of culture, and the permanent nature of the plantings appeal to those who have but limited time for gardening. The color range, from white through all shades of pink to the darkest of reds, the fragrance, the beauty of form, and the lasting quality of the cut flowers make the peony especially valuable for decorative purposes.

The foregoing qualities appeal as much perhaps to farmers and village dwellers as to other persons, but it is particularly for hardiness, ease of culture, and freedom from pests that the peony is recommended as pre-eminently the flower for the farmer and the village dweller. Engrossed in their own labors, with little or no leisure, these persons have no time for flowers that require special care at certain periods. For a moderate outlay nothing will give so much joy and satisfaction or endure so long without special care as will the peony.

EARLY HISTORY

The peony is one of the oldest of garden flowers. It has been cultivated in China for two thousand years. Early records indicate that the roots were used both for food and medicinal purposes. The flowers were prized for their decorative value, holding somewhat the same sentimental appeal that the forget-me-not does with the English. Both the herbaceous and the woody, or tree, peonies were cultivated by the Chinese. There is a myth that the tree peony was developed by skillful gardeners from the herbaceous type. The translations "King of Flowers" and "The King's Ministers" express the relative esteem with which the tree and herbaceous peonies were held. This expresses the feeling of the Japanese as well, though the Japanese know the peony as an introduced rather than a native plant. In both China and Japan the peony flourished in the temple gardens where many varieties were cultivated with the greatest of care.

Paeonia officinalis, whose descendants are the old red peonies of grandmother's garden, is native to southern Europe and to Asia Minor. In Greek mythology, Paean cured the wounded Pluto with this plant. The early Greek and Roman writers relate the virtues of the peony as do the herbalists of the middle ages.

FIGURE 1. PAEONIA OFFICINALIS
This peony of grandmother's day flowers in late May, and is now popular for rock gardens

FLOWERING SEASON

The flowering season for any one peony plant is relatively short, varying according to weather conditions from three to ten days. The careful selection of varieties will enable the gardener to extend the season of bloom to as long as a month. For those who are willing to venture from the beaten path and grow some of the species, a reward of two months of bloom is easily within their grasp.

Paeonia tenuifolia

P. tenuifolia is the first of the peonies to flower in the spring. The bright blood-red blossoms open about the middle of May in Ithaca. *P. tenuifolia* is native to the region north of the Black Sea and grows to a height of 18 inches. The fine fern-like foliage dies back during the early summer. Both the single and double forms are well adapted to rock gardens.

Paeonia Wittmanniana hybrids

Following immediately, and often flowering at the same time as *P. tenuifolia,* are the *Wittmanniana* hybrids. The varieties Avante Garde (pale rose), Le Printemps (yellow to cream), Mai Fleuri (light salmon), and Messagere (sulfur yellow) were originated by Victor Lemoine of France. They are the best-known hybrids of the light primrose yellow *P. Wittmanniana* with the varieties of *P. albiflora.* The Wittmanniana hybrids have been somewhat disregarded because of their lack of hardiness and of consistent performance. The beauty of the flowers compensates these faults in a measure at least.

Paeonia officinalis

The varieties of *P. officinalis* open their old-fashioned blooms in late May. The red peony (*rubra plena*) of grandmother's garden is again fashionable. Its low growth and its early flowering make it a favorite for the border and for the rock garden. The forms *alba plena* (double, white), *rosea plena* (double, rose), *lobata* (single, scarlet), and Otto Froebel (single, salmon-rose) constitute the remainder of this group.

Tree peonies

The varieties of the tree peony flower about a week in advance of those of *P. albiflora.* Many of the tree varieties surpass the general herbaceous group in color, size, and form. The woody stems of the tree peony do not die down each winter but are hardy throughout this part of the State. In northern New York a light winter protection might be necessary. A well-drained, rich, and friable soil is essential for the successful culture of this

TABLE 1. VARIETIES OF THE TREE PEONY

Variety	Origin	Date	Type	Color
Akashi-nishiki (Talma)	Japan	1910	Single	Rose-scarlet, rose
Athlete	Mouchelet	1867	Double	Pale rose-purple
Beatrix	Dessert	1905	Japanese	Pure white
Beaute de Twickel	Verdier	1869	Double	Lilac-rose
Bijou de Chusan (Jewel of Chusan)	Fortune	1846	Double	Pale pink
Comtess de Tuder	Gombault	1889	Double	Rose-pink
Dai-Kagura (Nuage Rose)	Japan	1893	Japanese	Rose-red
Dokusbin-den	Japan	1913	Japanese	Pale blush-pink
Gabisan	Japan	1898	Single	White
Haku-gan (Moussiline)	Japan	1893	Single	Pure white
Kinipaiseten	Japan	1913	Single	White
Kintajio	Japan	1913	Single	Pale blush-pink
Kuro-botan (Negress)	Japan	1896	Single	Black-red
Mikasa-Yama	Japan	1898	Single	Rose-red
Negricans (Princess Amelie; Germania)	Japan	1864	Japanese	Purple
Reine Elizabeth (Elizabeth; Mme. Edouard Seneclauze; Onyx; Jupiter)	Casaretto	1846?	Double	Rose-red
Ruriban	Japan	1893	Single	Indigo purple
Saigya-Zakura (Femina)	Japan	1893	Japan	Pale blush-pink
Seiriu (Dragon)	Japan	1910	Japanese	White
Souvenir de Ducher	Ducher	1889	Double	Purple
Triomphe de Vandermaelen	Vandermaelen	1867	Double	Lilac-rose

plant. Highly concentrated fertilizers must not be used; light applications may be given the plants after flowering or during the late summer.

A list of the highest rating varieties now in the American trade is given as table 1. The list includes the majority of the colors and types of this plant.

Yellow peonies

Gardeners interested in yellow peonies will find satisfaction in *P. lutea* (tree type), *P. Wittmanniana* and *P. Mlokosewitchii* (herbaceous). These peonies grow slowly and flower in advance of the earliest of the *albiflora* varieties. Aside from their possible value in the production of yellow varieties of herbaceous type they are of interest chiefly as novelties. Argosy, recently introduced by Dr. A. P. Saunders, is a rich golden-yellow variety of special merit.

PAEONIA ALBIFLORA

Horticultural types

The present discussion is confined mainly to the varieties of *P. albiflora.* For horticultural purposes these varieties are classified into four groups: single, or Chinese; Japanese; anemone; semi-double and double group. This system of classification was adopted in 1928 by the American Peony Society and was published in their manual *Peonies.* The *single type* is a flower with five or more true petals arranged around a center made up of stamens with pollen-bearing anthers. The *Japanese type* is really a double form, characterized by five or more guard petals and a center made up of stamens bearing abortive anthers, nearly or completely devoid of pollen. The *Anemone type* resembles somewhat the Japanese but is distinguished by the absence of anthers, while the filaments of the stamens have taken on a petal-like character and are narrow, more or less incurved, and imbricated. In the *double type* the transformation of the stamens, and sometimes the stigmas, into petals has advanced to that stage where they make up the body of the flower. The *semi-doubles* always show a greater or less number of broad petals intermixed with the stamens, the latter always a prominent feature.

The single, Japanese, and anemone types of peony are especially adapted to landscape planting. Growth is vigorous and they flower profusely in globular masses. The blooms open well above the foliage. After the flowering season the dead blooms may be removed easily, and the attractive green foliage makes an excellent background for summer flowers. Peonies may be used to advantage in large beds for mass effect. In this way delicate colorings, which in the individual plant or flower are seldom realized, may be intensified. For the formal garden, the peony is especially valuable because the plantings are permanent and because the color value of both the

FIGURE 2. A TREE PEONY

Tree peonies, so highly prized in China and Japan, offer a range of colors not found among present-day herbaceous varieties. These peonies are worthy garden plants and deserve serious consideration

FIGURE 3. SINGLE TYPE
The flower has five or more true petals about a center of pollen-bearing stamens

FIGURE 4. JAPANESE TYPE

The flower has five or more guard petals. Generally the stamens are devoid of pollen and some are modified in size and color

bright flowers and the clear, cool, green foliage persists until the severe frosts of late fall.

The semi-double and double varieties are the most common and generally considered the most beautiful of all peonies. The flowers are so large and heavy that a rain storm will cause the stems to bend till the blossoms rest on the soil from the weight of the water they contain. This limits their use for landscape purposes unless the plants are disbudded and staked before the blooms open.

FIGURE 5. ANEMONE TYPE

The flower has five or more guard petals. The stamens are so modified as to resemble petals and are uniform in size. Flowers of this type are often classed with those of the double varieties

FIGURE 6. SEMI-DOUBLE TYPE
The flower has practically all the characteristics of the double type of peony

When used as cut flowers the double peonies are particularly prized. Tight buds that have been cut and then allowed to open in a cool cellar have excellent color. Many light-colored varieties have a pleasant fragrance which adds to their attractiveness. Both the single and the double forms are dependable cut flowers. A single bloom in appropriate surroundings makes an admirable bouquet, while blooms attractively arranged in baskets are suitable for large rooms, halls, or churches. The single varieties are

FIGURE 7. DOUBLE TYPE

The transformation of the stamens and stigmas to petals is practically complete and uniform, so these modified petals closely resemble the guard petals in size and color and make up the body of the flower

not practical for table decoration because the pollen which falls in abundance may stain furniture.

Color range

The color range in herbaceous peonies lacks yellow and blue tones. The whites vary, according to the substance and the texture of the flower, from a thin watery white to a deep, rich, milk-white. A few varieties are definitely of a cream color, due either to a faint green or pink tint rather than to true yellow. Although the pinks range in depth of color from very light to the deepest of tones, the majority are of the rose-pink rather than the salmon-pink family. The reds vary from light, bright red to the deepest of maroons often described as black. Color in peonies varies with the soil type, the season, and with the age of the plants. These variations are most noticeable in the light-pink varieties, but are by no means characteristic of that group alone. The size and form of the flower varies in a similar way.

Time of bloom

Among the varieties of *P. albiflora,* the single or Chinese peonies are the first to bloom. These are followed, in a general way, by the Japanese and double forms. The time of bloom for these different classes, however, does overlap, and in some years practically all varieties flower at the same time. The notations in table 2 refer to the flowering season in general.

Size of blooms and of plants

While the size of the bloom varies with the season and with general growth conditions, especially those of soil moisture, with the age of the plant, and, with the practice of disbudding, the smallest blooms exceed 3 inches in diameter and the largest ones may be as much as 9 inches in diameter. For average garden conditions flowers of 4 to 7 inches in diameter may be expected.

The plants vary in height from 18 to 40 inches. The dwarf plants are of compact globular form, while the taller ones vary from full, compact plants through spreading open forms to those of upright, stiff, but restricted, growth.

List of varieties

Some twelve hundred varieties of herbaceous peonies are offered in the catalogs of American nurserymen. Some of these varieties are duplicates, but the vast majority have their peculiar virtues and faults which set them apart from others. In compiling table 2, of approximately two hundred varieties, an effort has been made to cover all the various types and colors but at the same time to limit the list to well-known, reliable, and moderate-priced varieties.

The abbreviations in table 2 are: Size of flower: L., large; M., medium; S., small. Height of plant: T., tall; M., medium; M.T., medium tall; D., dwarf; M.D., medium dwarf. Season of bloom: E., early; M., medium; M.E., medium early; L., late; M.L., medium late. Fragrance: D., disagreeable; F., faint; P., poor; S., strong.

TABLE 2. VARIETIES OF PEONIES, CLASSIFIED BY TYPE

Variety	Rating*	Originator	Size of flowers	Height of plant	Season of bloom	Fragrance	Color	
							Petals	Stamens
Single								
Black Prince	8.5	Thurlow	L.	M.	M.	D.	Crimson	Yellow
Flanders Fields	8.74	Brand	M.	M.	M.	.....	Red	Golden
Helen	8.88	Thurlow	M.	T.	E.	.....	Pink	Yellow
Jeanne Ernould	8.88	Doriat	....	.....	.....	.....	Silvery carmine	Yellow
Jewel	8.98	Glasscock	....	.....	.....	.....	.....	.....
Jimmie Franklin	8.60	Franklin	M.	M.	M.	.....	Dark red	Yellow
L'Etincelante	8.4	Dessert	L.	T.	M.	S.	Pink	Yellow
Le Jour	8.6	Shaylor	L.	M.	M. E.	S.	White	Yellow
Mellin Knight	8.49	Brand	L.	T.	M.	.....	Red, crimson	Yellow
Mischief	8.66	Auten	M.	M.	L.	S.	Pink	Yellow
Nellie	8.40	Kelway	M.	D.	M.	D.	Blush	Yellow
Presto	8.60	Auten	M.	M.	M.	.....	Red-purple	Yellow
Pride of Langport	8.9	Kelway	L.	T.	M.	S.	Pink	Golden
Scarf Dance	...	Auten	M.	D.	M.	.....	Light pink	Yellow
Stanley	7.8	Kelway	L.	T.	M.	S.	Dark crimson	Yellow
The Bride	8.4	Dessert	L.	T.	E.	S.	White	Yellow
Vera	8.79	Gumm	L.	M. T.	E. M.	.....	Red-maroon	Yellow
Verdun	8.95	Dessert-Doriat	L.	M. T.	E. M.	.....	Crimson-red	Yellow

Variety	Rating*	Originator	Size of flowers	Height of plant	Season of bloom	Fragrance	Color	
							Petals	Stamenoids
Japanese								
Alma	8.5	Shaylor	M.	M. T.	M.	.....	Pink	Yellow
Ama-no-sode	9.2	.....	L.	M.	M.	.....	Rose-pink	Yellow, rose
Charm	9.27	Franklin	L.	M. T.	L.	.....	Deep red	.....
Departing Sun	8.5	.....	L.	M.	M.	.....	Crimson-rose	Rose, yellow
Flamboyant	8.5	.....	L.	T.	M.	P.	Violet-crimson	Yellow
Fuyajo	9.2	.....	M.	T.	M.	S.	Maroon	Buff, old rose
Gold Mine	8.2	Hollis	M.	M.	M.	P.	Deep rose-pink	Pink-yellow
Hakodate	9.03	Millet	L.	M.	M.	.....	White	.....
Hari-ai-nin	8.90	Babcock	M.	M.	M.	.....	Dark red	.....
Instituteur Doriat	8.85	Doriat	L.	T.	L.	.....	Red	.....
Isami Jishi } Isani Gidui }	9.3	.....	L.	M. T.	M.	P.	White	Buff
Jap Giant	9.00	Franklin	L.	M.	M.	.....	.....	.....
Jeanne Lapandry	8.50	Doriat	L.	M.	M.	.....	White	Yellow
King of England	8.6	Kelway	L.	T.	E. M.	S.	Ruby-madder	Buff-pink
Kukeni-jishi	9.5	.....	L.	M. T.	E. M.	F.	Silvery pink	Yellow
Madam Butterfly	9.05	Franklin	M.	M. T.	M.	.....	Rose-pink	.....
Margaret Atwood	8.7	.....	L.	M. T.	M.	S.	White	Golden yellow
Mikado	8.6	Japan	M.	T.	M.	D.	Crimson	Rose red, buff
Mrs. Mac	8.65	Franklin	M.	M.	M.	.....	Pink	Yellow
Nippon Beauty	9.38	Auten	L.	M.	L.	.....	Deep red	Yellow
Onahama	8.87	Gumm	L.	M.	M.	.....	Dark red	.....
Prairie Afire	8.80	Brand	L.	M. T.	M.	.....	Cream-rose	Red
Princess Duleep Singh	8.7	Kelway	M.	T.	E. M.	F.	Deep rose-pink	Buff-yellow
Rashoomon	8.7	.....	L.	M. T.	M	F.	Rose-red	Pink, yellow
Ruth Force	8.33	Shaylor	M.	M.	L. M.	.....	Cerise-pink	Yellow-pink
Snow Sheel	8.3	.....	L.	D.	M.	D.	White	Yellow
Tamate-Boku	9.4	.....	L.	M.	M.	Faint	Pink	Yellow, pink
Tokio	8.9	Dessert	L.	T.	M.	.....	Rose-pink	Pale yellow
Toro-no-maki	9.0	.....	L.	D.	L. M.	Not	Blush-white	Amber yellow

*On scale of 10. Ratings taken from *Peonies, The Manual of the American Peony Society* (1928), and from the supplement to this manual (1933).

TABLE 2 (*continued*)

	Rating	Originator	Size of flowers	Height of plant	Season of bloom	Fragrance	Color of petals	
							Main	Secondary
				Anemone				
Aureolin	8.9	Shaylor	L.	M.	L. M.	F.	Rose-pink	Cream
Golden Dawn	8.43	Gumm	M.	M.	M.	F.	Ivory	Cream, yellow
Laura Dessert	8.8	Dessert	M.	M.	E. M.	F.	Pale pink	Cream
Philomele	7.7	Calot	M.	M.	E.	F.	Old rose	Buff
Primevere	8.6	Lemoine	M.	T.	M.	F.	Cream white	Canary yellow
Red Bird	8.40	Franklin	L.	M.	M.	.....	Dark red	Rose-red
				Double				
A. B. Franklin	9.51	Franklin	L.	T.	M.	F.	White	Blush
Acme	8.90	Franklin	L.	M. T.	L.	.....	Pink	.....
Adolphe Rousseau	8.5	Dessert, Méchin	L.	T.	E. M.	D.	Deep red	.....
Alesia	8.98	Lemoine	L.	M.	L. M.	F.	White	Cream
Alice Harding	9.39	Lemoine	M.	M.	M.	P.	White	Flesh pink
Argentine	8.76	Lemoine	M.	M.	L.	F.	White	.....
Auguste Dessert	8.7	Dessert	M.	M.	M.	.....	Pink	.....
Avalanche	8.7	Crousse	M.	M.	L. M.	F.	White	.....
Ball O'Cotton	8.8	Franklin	M.	M.	L. M.	.....	White	(Crimson edge)
Baroness Schroeder	9.0	Kelway	L.	T.	L. M.	F.	White	Cream-pink
Betty Blossom	8.73	Thurlow	M.	M.	L. M.	.....	White	Cream-yellow
Blanche King	8.90	Brand	L.	M.	L. M.	.....	Deep pink	.....
Cherry Hill	8.6	Thurlow	S.	T.	E.	.....	Red-maroon	.....
Chestine Gowdy	8.4	Brand	M.	T.	L.	F.	Pink, light rose	.....
Claire Dubois	8.7	Crousse	L.	M. T.	L.	D.	Pink, mauve	.....
Clemenceau	8.5	Dessert	M.	T.	L. M.	F.	Pink, rose	.....
Cornelia Shaylor	9.1	Shaylor	M.	M.	L.	S.	Pink, pale-rose	.....
Couronne d'Or	8.1	Calot	M.	M.	L.	F.	White	(Crimson tip)
David Harum	8.4	Brand	L.	T.	M.	.....	Red, light crimson	.....
Denise	8.74	Lemoine	M.	M.	M.	F.	Flesh-pink	Flecked
Diadem	8.95	Franklin	L.	M.	L.	F.	Pink	.....
Dr. J. H. Neeley	9.35	Good and Reese	M. L	M.	M.	.....	White	.....
Duchess de Nemours	8.1	Calot	M.	M.	E.	F.	White	.....
Edulis superba	7.6	Lémon	S.	T.	E.	F.	Pink, old rose	.....
Edward W. Becker	8.40	Franklin	M.	M. T.	M.	S.	Light pink	.....
Edwin C. Shaw	9.1	Thurlow	L.	M.	L. M.	F.	Light rose	Flesh-pink
E. J. Shaylor	8.65	Shaylor	M.	M.	L. M.	F.	Pink, deep rose	.....
Elizabeth Barrett Browning	9.2	Brand	L.	T.	L.	F.	White, cream	Red marks
Elizabeth Huntington	8.88	Sass	.....	.....	.....	.....	White	.....
Ella Christiansen	8.84	Brand	L.	T.	M.	F.	Pink	.....
Elsa Sass	9.18	Sass	.....	.....	.....	.....	Pink	.....
Elwood Pleas	8.7	Pleas	M.	M.	L.	F.	Pink, pale rose	.....
Enchanteresse	8.9	Lemoine	L.	T.	L.	S.	White-cream	Crimson tip
Eunice Shaylor	8.60	Shaylor	M.	M. T.	M.	F.	Pink, pale flesh	Crimson tip
Exquisite	8.5	Kelway	M.	M.	M.	P.	Pink-rose	.....
Félix Crousse	8.4	Crousse	M.	M.	L. M.	P.	Red-crimson	.....
Festiva maxima	9.3	Miellez	L.	T.	E.	F.	White	Crimson flakes
Florence Macbeth	8.99	Sass	L.	M.	L. M.	S.	Pale pink	.....
Frances Willard	9.1	Brand	M.	T.	L. M.	F.	White	Cream, pink
Frank E. Good	8.65	Good & Reese	M.	T.	M.	.....	White	Cream
Frankie Curtis	8.94	Vories	L.	M. T.	M.	.....	White	Pale flesh
Franklin's Pride	9.45	Franklin	L.	T.	L.	F.	Pink	.....

TABLE 2 (*continued*)

Variety	Rating	Originator	Size of flowers	Height of plant	Season of bloom	Fragrance	Color of petals	
							Main	Secondary
				Double				
General Gorgas	8.50	van Leeuwen	M.	M.	M.	F.	White	Rose-pink
Geneviève	8.65	Lemoine	L.	M.	L.	.....	White	Cream
Georgiana Shaylor	8.9	Shaylor	L.	M.	L. M.	F.	Pink, light rose	Crimson mark
Grace Batson	8.84	H. P. Saas	....	.....	.....	.....	.....	.....
Grace Loomis	9.2	Saunders	M.	M.	L.	S.	White	Lemon-cream
Grandiflora	8.8	Richardson	L.	T.	L.	F.	Pink	.....
Grover Cleveland	8.2	Terry	M.	M.	L. M.	S.	Red	.....
Hansina Brand	9.04	Brand	L.	T.	M.	F.	Pink	.....
Hazel Kinney	8.71	Brand	M.	M.	L. M.	.....	Light pink	.....
Henry Avery	8.8	Brand	M.	M.	L.	S.	Light pink	Cream
Inspecteur Lavergne	8.67	Doriat	M.	T.	E.	.....	Crimson	.....
James Boyd	8.9	Thurlow	M.	M. T.	L.	F.	Flesh pink	Cream
James Kelway	8.7	Kelway	L.	T.	E. M.	.....	Pale pink	.....
James R. Mann	8.7	Thurlow	M.	M.	M.	.....	Pink	.....
Jeannot	9.2	Dessert	M.	M.	L.	.....	Pink	.....
John M. Good	8.89	Welsh	M.	T.	L. M.	F.	White	Pale pink-cream
Jubilee	8.9	Pleas	L.	T.	M.	F.	White	Cream
Judge Berry	8.6	Brand	L.	M.	E.	S.	Pink, light rose	.....
Judge Snook	9.50	Neeley	....	.....	.....	.....	Pink	.....
June Day	9.07	Franklin	M.	M.	M.	F.	Pink, light old-rose	Lavender
Karl Rosenfield	8.8	Rosenfield	M.	T.	M.	N.	Red, crimson	.....
Katherine Havemeyer	9.0	Thurlow	M.	M.	M.	F.	Pink, light rose	.....
Kelway's Glorious	9.8	Kelway	L.	M.	M.	F.	White	Cream
Kelway's Queen	8.8	Kelway	M.	M.	L. M.	F.	Flesh pink	Red flake
La Fée	9.2	Lemoine	L.	T.	E. M.	F.	Rose, light pink	Cream-pink
La France	9.0	Lemoine	L.	T.	L.	F.	Rose, light pink	.....
La Lorraine	9.06	Lemoine	M.	T.	M.	P.	White	Cream
La Perle	8.5	Crousse	M.	M.	M. L.	F.	Pink, light rose	Red flake
Lady Alexander Duff	9.1	Kelway	M.	M.	M.	P.	Rose-white	.....
Lady Kate	8.85	Vories	M.	T.	M. L.	.....	Light pink	.....
Lake O'Silver	8.62	Franklin	S.	M.	M.	.....	Pink	.....
Laverne Christman	8.83	Brand	L.	T.	M.	.....	Deep pink	.....
Le Cygne	9.9	Lemoine	L.	M.	M. E.	F.	White	Ivory
Lillian Gumm	8.95	Gumm	L.	T.	L. M.	F.	Pink, deep rose	.....
Longfellow	9.0	Brand	M.	M. D.	M.	S.	Red, crimson	.....
Lora Dexheimer	8.4	Brand	M.	M.	M.	F.	Red, crimson	.....
Lorch	8.69	Goos & Koememann	M.	M.	M.	F.	White	Lemon-cream
Mabel L. Franklin	9.0	Franklin	L.	M.	M.	F.	Pink	Lavender
Madame Calot	8.1	Miellez	M.	T.	E.	F.	Pink, light old rose	Crimson flakes
Madame de Verneville	7.9	Crousse	S.	M.	E.	F.	White	Blush
Madame Emile Debatène	8.75	Dessert-Doriat	L.	M.	M.	.....	Pink	Silvery
Madame Emile Gallé	8.5	Crousse	M.	M.	L.	F.	Pink, light rose	.....
Madame Emile Lemoine	8.9	Lemoine	M.	T.	M.	F.	White	Crimson flakes
Madame Forel	7.7	Crousse	L.	M.	L. M.	F.	Pink-lavender	.....
Madame Geissler	7.9	Crousse	L.	M.	L. M.	.....	Pink, light old rose	.....
Madame Jules Dessert	9.4	Dessert	L.	T.	L. M.	F.	Flesh White	.....
Marie Crousse	8.9	Crousse	L.	M.	M.	F.	Pale pink	.....
Marie Jacquin	8.3	Verdier	M.	M.	M.	F.	Blush white	.....
Marie Lemoine	8.5	Calot	L.	D.	L.	F.	White	Cream
Martha Bulloch	9.1	Brand	L.	T.	L.	F.	Pink, old rose	.....
Mary Brand	8.7	Brand	M.	M.	M.	F.	Red, dark crimson	.....
Mary Woodbury Shaylor	9.0	Shaylor	L.	D.	L. M.	F.	Flesh white	Crimson flecks
Matilda Lewis	9.19	Saunders	M.	M.	L.	.....	Dark mahogany	.....
Milton Hill	9.0	Richardson	M.	M.	L.	.....	Light pink	.....

TABLE 2 (*concluded*)

Variety	Rating	Originator	Size of flowers	Height of plant	Season of bloom	Fragrance	Color of petals	
							Main	Secondary
					Double			
Minnie Shaylor	8.93	Shaylor	M.	M.	M.	.....	Light pink	.....
Minuet	9.35	Franklin	L.	T.	L.	.....	Light pink	.....
Monsieur Jules Elie	9.2	Crousse	L.	T.	E. M.	F.	Pink-rose	.....
Monsieur Martin Cahuzac	8.8	Dessert	M.	M.	E. M.	D.	Red-maroon	.....
Mr. L. van Leeuwen	8.62	Nieuwenhuyzen	L.	M.	L.M.	F.	Red	.....
Mrs. A. B. Franklin	9.41	Franklin	L.	M.	L.	F.	White	.....
Mrs. A. M. Brand	9.04	Brand	L.	M. T.	L.	F.	White	.....
Mrs. C. S. Minot	9.2	Minot	L.	D.	L.	F.	Pink	.....
Mrs. Dean Funk	9.05	Brand	M.	M.	M.	.....	Pink	.....
Mrs. Edward Harding	9.3	Shaylor	M.	M.	M.	S.	White	.....
Mrs. F. A. Goodrich	8.88	Brand	M.	M.	L.	F.	Deep pink	.....
Mrs. Frank Beach	8.95	Brand	M.	M. D.	L.	E.	White	Cream
Mrs. Harriet Gentry	8.95	Brand	M.	T.	L.	.....	White	.....
Mrs. John M. Good	9.10	Good Reese	M.	M.	L. M.	.....	White	.....
Mrs. John M. Kleitsch	8.98	Brand	L.	M. T.	L.	F.	Pink, light rose	Lavender
Mrs. J. V. Edlund	9.44	Edlund	M.	M.	L.	.....	White	.....
Mrs. Romaine B. Ware	8.85	Brand	M.	T.	M.	S.	Pink, light flesh	.....
Mrs. W. L. Gumm	9.30	Gumm	M.	M.	M.	.....	Pink	.....
Myrtle Gentry	9.06	Brand	L.	M. T.	L. M.	F.	Pink	Flesh
Nancy Dolman	8.92	Vories	L.	T.	L.	.....	Pink, pale rose	.....
Nell Shaylor	8.67	Shaylor	L.	D.	M.	F.	Shell pink	.....
Nina Secor	9.0	Secor	M.	M.	M.	D.	White	Cream
Octavie Demay	8.5	Calot	M.	D.	E.	F.	Pink, light rose	Crimson flakes
Philippe Rivoire	9.2	Rivière	S.	M.	M.	F.	Red, dark crimson	.....
Phoebe Cary	8.8	Brand	M.	T.	L.	F.	Pale pink	.....
Phyllis Kelway	9.0	Kelway	L.	M.	M.	S.	Pink-rose	.....
President Wilson	9.3	Thurlow	L.	M.	L.	F.	Pink-rose	.....
Pride of Essex	8.9	Thurlow	M.	T.	M.	F.	Pink	Blush
Rachel	8.3	Lemoine	M.	M.	M. L.	S.	Pink, light rose	.....
Raoul Dessert	9.0	Dessert	M.	M.	L.	F.	Pink	.....
Reine Hortense	8.7	Calot	L.	T.	M.	S.	Pink-rose	Crimson fleck
Richard Carvel	8.8	Brand	M.	T.	E.	S.	Crimson	.....
Rosa Bonheur	9.0	Dessert	L.	M.	L.	F.	Pink, old rose	.....
Rose Shaylor	9.1	Shaylor	L.	T.	M.	F.	Light Pink	Cream
Sarah Bernhardt	9.0	Lemoine	L.	M.	L.	F.	Pink, deep rose	.....
Sarah Carstensen	8.5	Terry	M.	D.	M.	S.	Pink, light rose	Crimson flake
Sarah K. Thurlow	9.1	Thurlow	M.	M.	L.	F.	White	Blush
Silvia Saunders	9.04	Saunders	S.	D.	E.	P.	Pink-rose	.....
Solange	9.7	Lemoine	L.	M. T.	M.	F.	White-cream	Buff pink
Souvenir de Louis Bigot	9.1	Dessert	M.	M.	M.	F.	Pink	Salmon
Thérèse	9.8	Dessert	L.	M.	M.	F.	Pink, pale old rose	.....
Thomas C. Thurlow	9.1	Thurlow	M.	M.	M.	F.	Pink-white	Cream
Tourangelle	9.4	Dessert	M.	M.	L.	F.	Pink	Cream
Venus	8.3	Kelway	M.	T.	M.	F.	Pale pink	Lavender
Victoire de la Marne	8.2	Dessert	L.	M.	M.	D.	Purple-red	.....
Victory Chateau Thierry	8.92	Brand	L.	M. D.	M.	F.	Pink	.....
Walter Faxon	9.3	Richardson	S.	M.	M.	F.	Pink	Shell pink
W. F. Christman	8.8	Franklin	M.	M.	M.	F.	Pink	Flesh white
Wilton Lockwood	8.8	Shaylor	L.	T.	M.	F.	Light rose-pink	.....
William F. Turner	8.4	Shaylor	M.	T.	E. M.	.....	Crimson	.....

FIGURE 8. CLAIRE DUBOIS
Large, late-flowering, mauve pink

Garden culture

Soil

The cultivation of the peony is relatively simple, for the plants will thrive in practically all types of garden soil. It is essential that the soil be well drained and that the plants receive plenty of sunlight and soil moisture during the flowering period. Once a planting has become established, it will produce excellent flowers for a number of years, provided the plants are maintained in a healthy condition.

Peonies thrive best in a rich heavy loam. A deep clay loam that has been made friable by thorough drainage and judicious handling is better than other types of soil. A sandy loam offers certain inducements to the com-

mercial grower, for the plants are easy to lift and to clean for packing and shipment.

Deep preparation of the soil is important, as it improves drainage conditions and permits the incorporation of manure and other organic matter into the soil. Fresh manure should not be used in the preparation of soil for peonies. Low areas that tend to become waterlogged in winter need special consideration. If such locations are used, artificial drainage must be provided. The soil may be dug out to a depth of 18 inches or more, and a layer of stones and gravel is put in the bottom of the trench before the surface soil is replaced.

Fertilization

The matter of fertilizer is largely one for the individual grower to determine. Recent experiments at the trial grounds at the University of Illinois do not show any consistent and clear-cut response to the standard fertilizers generally recommended by peony growers. The use of liquid manures and highly concentrated commercial fertilizers may stimulate growth and flower production for a year, but it is the experience of at least one large grower that growth and production the following season are restrained.

FIGURE 9. DUCHESS DE NEMOURS
Early flowering, white

FIGURE 10. FELIX CROUSSE
Flowering in late midseason; brilliant red-crimson

FIGURE 11. MADAME EMILE GALLÉ
Late-flowering, light rose-pink

Location

The planting should have full exposure to the sun. A neighboring windbreak of trees or tall shrubs will protect the plants and the blooms from wind and driving rains during the flowering period. The trees and shrubs should not be so close to the planting that their roots compete with those of the peonies for plant food and for moisture, nor should these plants seriously shade the peonies.

FIGURE 12. MADAME FOREL
Of medium height, flowering in late midseason, lavender-pink

Season for planting

Early fall, September 1 to October 15, is the season generally recommended for peony planting. In New York State it is advisable to provide a light mulch of straw, evergreen, or other material during the first winter. The mulch will help to prevent the roots from heaving and is applied as soon as the ground freezes. It is removed the following spring during the April clean-up activities. Spring planting of peonies permits the preparation of the soil in the fall of the year, eliminates the possibility of loss from heaving, and makes it possible for the young plants to become thoroughly established before going through their first winter. The chief difficulty in spring planting is to obtain dormant plants at a time when planting is possible. The improved storage warehouses of nurserymen now make it possible for them to keep peonies in a dormant condition till relatively late in the spring.

Planting

Planting peonies at the correct depth in the soil is one, if not the most, important phase of peony culture. As the plant grows in the field the buds are at or just above the surface of the soil (figure 16). The gardener will do well to simulate these conditions when setting his plants. If the buds, or eyes, are buried from 2 to several inches below the surface of the soil, the plants are not thrifty and often entirely fail to bloom or even to produce flower buds.

The hole in which the peony division is set must be large enough for the roots to be spread as much as necessary. A stick laid across the top of the hole will help one to judge the correct depth at which the root should be set. The soil is firmed about the roots. This does not mean that the soil

FIGURE 13. MARIE LEMOINE
Large, late-flowering, cream-white

FIGURE 14. OCTAVIE DEMAY

Rather dwarf, early-flowering, light rose-pink, good as cut flower or for landscape planting

should be tamped down, but the division should be firmly in place when all the soil has been returned. Plantings in dry soil must be watered.

A space of at least 4 feet should be left between adjacent roots or clumps. While the plants are young this may appear to be too much but in a mature planting, especially of the vigorously growing Japanese type and of spreading types of double peonies, 4 feet is barely enough room between clumps. Dwarf varieties may be set as close as 2 feet when the clumps are intended to form a compact row or hedge.

Cultivation

The peony beds should be thoroughly weeded and cultivated early in the spring. The plants must be inspected for disease and any necessary precautions taken. The young plants grow rapidly and as soon as the foliage is 2 feet in height special care should be taken to provide adequate soil moisture. Frequent cultivation is important, and, if the season is a dry one, artificial watering may be necessary.

Disbudding

During May the main flower bud will make its appearance and will be followed by one or more side buds. When flowers of fine quality are desired, the plants should be disbudded; that is, all but the main flower buds are pinched out as soon as they are large enough to handle. This process limits the flowering to one blossom on each stem. If the plant is one of the Japanese or single types and is cultivated for its landscape value, the side buds will be left to flower in the normal manner.

FIGURE 15. A CLUMP OF SINGLE PEONIES

The single type of peony is especially adapted to landscape planting. The plant should have full exposure to the sun

FIGURE 16. PLANTING PEONY ROOTS

The buds, or eyes, must be planted close to the surface, not buried from 2 to 6 inches deep

FIGURE 17. WORKING SOIL AROUND PEONY ROOTS

The roots must be spread out and good rich soil must be worked in around them

Cutting blooms

To get the most enjoyment from the peony as a cut flower, the stem should be cut during the early part of the forenoon while the bud is still tightly closed though the petals are visible. A few of the late-flowering double varieties must be allowed to partially open before they are cut, but the vast majority will flower perfectly when cut as the buds first show color. The stems should be at once placed in a deep vase of cool water and left in the cellar for a few hours before they are arranged. Peony blossoms handled in this manner open gradually, disclosing many delicate colorings which are lost out-of-doors in the hot sun.

FIGURE 18. PEONY ROOT HEAVED OUT BY FROST

When peonies are planted in the fall, a light mulch of straw or evergreen should be applied as soon as the ground freezes. The mulch may be removed during April and need not be applied again except in the northern part of the State or for the protection of the less-hardy species and hybrids

Removal of old flowers

After the flowering season the old blossoms are removed and the plants are cultivated and weeded. The foliage should be kept in a clean healthy condition until late fall. A few varieties have particularly good autumn colors in red and purple shades. The foliage of the majority of the varieties turns a dull green to yellow and is best removed after the first fall frost. The stems are cut off close to the ground and the foliage is gathered and burned. If winter protection is necessary, straw or other material of a similar nature may be used, but the old foliage which harbors diseases must be destroyed.

Culture as a cut flower

The peony is a popular flower for Decoration Day, and the plant is sometimes cultivated exclusively for the cut flowers. Success depends upon the selection of varieties that will sell well; red varieties seem to be especially popular as do also white ones. In addition to good clear color the variety must be a vigorous grower, flowering freely and propagating readily. Early varieties of good quality are few in number.

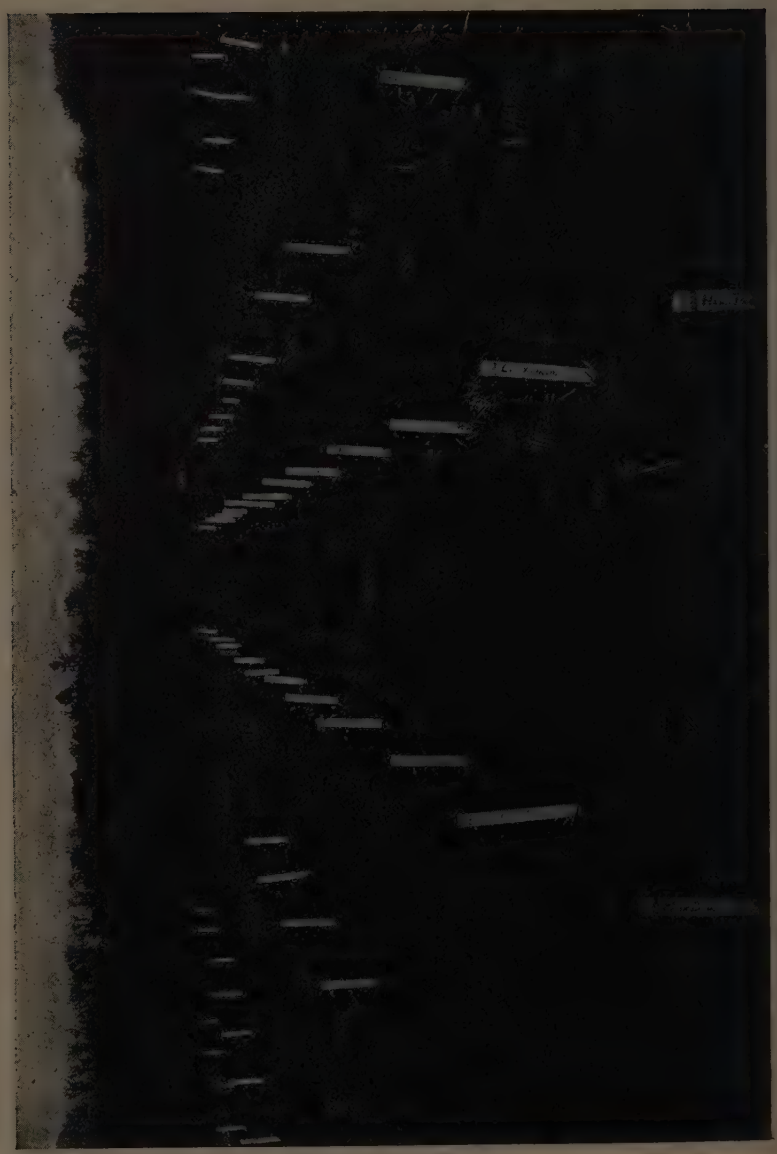

FIGURE 19. MULCHING PEONIES

Soil

A well-drained soil is important, and the possibility of watering the plants in dry season must be taken into account. The soil may be enriched by the application of a liberal coating of well-rotted manure or by plowing under a cover crop of clover, soybean, or some other legume. This must be done several weeks before planting, and the soil should be brought to a fine state of tilth.

Planting

Plants set closer than 3 by 3 feet are difficult to cultivate after they have reached the budding stage. When cultivation is to be done by tractor, the rows should be 3½ feet apart. Some growers plow a furrow in which to set the plants, others carefully mark the field, dig the holes by hand, and set the plants so that the eyes are just below the surface of the soil.

In large plantings, the growers set each variety in a separate block and so place the roads that the labor in cutting and handling the flowers is reduced to a minimum. Each grower has his own special methods best adapted to his situation.

Cultivation

Cultivation should begin early in the spring and should be continued till late fall. Highly concentrated fertilizers are seldom used, though the plants respond to watering at flowering time. For high-quality flowers the plants should be disbudded, leaving but a single bud on each stem. Many growers break the terminal bud on the weak stems, thus leaving the foliage to support the later growth of the plants.

Cutting and storage

The proper stage for cutting will depend upon the demand for the flowers. If the grower finds that he can sell his crop as the flowers approach full bloom, it will not be necessary to place the flowers in cold storage. Large quantities of peonies are raised primarily for sale as storage flowers. The buds are cut just as they show color and start to open. This depends somewhat on the variety; early loose-petaled varieties are cut in tight bud, while late-flowering, heavy-petaled varieties are allowed to partially open. The cut flowers are taken at once to the cold storage where they are set in water and stored at 38° F. for short periods or at 33° to 35° F. for periods of two weeks or more. It is not at all unusual to store the flowers from July to September with relatively little loss.

FIGURE 20. A FIFTEEN-YEAR-OLD CLUMP DUG AND WITH THE SOIL WASHED FROM THE ROOTS; READY FOR DIVISION

Neglected plantings are best renovated by digging and dividing the old clump

FIGURE 21. EIGHT DIVISIONS OBTAINED FROM THE PEONY CLUMP SHOWN IN FIGURE 20

When set in fresh rich soil, these divisions will produce clumps in three years. Some will flower the first summer, but the first satisfactory bloom should not be expected until the second or third year

PEONY DISEASES

C. E. F. GUTERMAN

Although many people still believe that peonies are free from disease, the fact remains that these plants are susceptible to a number of troubles, some of which are of minor and others of major importance. These diseases are of various types, including blights, stem rot, wilt, root-knot, leafspots, and virus troubles. In the following discussion an attempt has been made to provide those interested in these plants with the latest information on the symptoms, the cause, and the control of the more common or important diseases.

Botrytis blight

Of the several diseases to which peonies are susceptible, Botrytis blight should receive first consideration as the most common and generally destructive. Various reports in the literature would indicate that the disease occurs in practically all regions in temperate North America and Europe where peonies are grown. The chief losses from Botrytis blight are the destruction of young shoots early in the spring and the blighting or rotting of the buds and flowers. In addition, the foliage may be blighted, thus serving to reduce the vigor of the plants as well as to detract from their ornamental value.

Symptoms

Early in the spring, the causal fungus attacks the young succulent shoots and causes them to wilt suddenly and to topple (figure 22). Shoots in all stages of growth, up to and including those showing buds, are susceptible to this type of injury which is characterized by a soft brown rot of the stem that extends above and below the surface of the soil. In rare instances, the rot may extend down into the roots. Small buds, when attacked, cease growth and turn black. A bud blast similar in appearance to that produced by Botrytis blight can result from other causes such as Phytophthora blight, poor vigor of the plants, and too deep planting. When older buds are affected (figure 23), the petals become watery and matted, turn brown, and die. In later stages, the rot may extend down the flower stem for a considerable distance. Open flowers, when attacked, turn brown, droop, and become a rotted mass of petals. Infected leaves exhibit circular or triangular lesions with zonations of dark and light brown. The lesions vary considerably in size, and in some instances may involve an entire leaflet. The fungus may grow down through an infected leaf into the stem where a typical brown canker is formed.

Cause

Botrytis blight is caused by the fungus *Botrytis paeoniae* Oud. which overwinters both as dormant mycelium or small, brown to black sclerotia

on infested stems and other plant debris. With the advent of rains and warm weather in early spring, large numbers of microscopic spores or seeds are developed in grape-like clusters. Splashing rain, air currents, or insects serve to carry these spores to the young peony shoots where they germinate and cause the primary infections. As the young shoots wilt and rot, additional spores are formed on the diseased areas and these in turn are carried to leaves, buds, and stems which have subsequently developed. In this connection, the rôle played by ants in carrying spores to the buds should be emphasized. The sugary exudate which commonly covers the developing peony buds is a great attraction to ants. While climbing the stems to obtain this sweet liquid the ants may become dusted with large numbers of spores which adhere to the sticky buds, produce infection, and cause the typical bud-blast condition.

Control

Measures for the control of Botrytis blight should begin with a thorough clean-up each fall. As soon as the tops have died down, all stems, leaves, and

FIGURE 22. WILTING OF YOUNG PEONY SHOOTS FOLLOWING INFECTION WITH BOTRYTIS PAEONIAE

FIGURE 23. BUD BLIGHT FOLLOWING INFECTION WITH BOTRYTIS PAEONIAE

other plant debris should be carefully gathered and burned. Many of the better growers go to the extent of pulling the soil away from the crowns thus to cut off the stems as close as possible to the roots. Experience has proved that sanitation of this sort will serve to destroy the overwintering pathogene and materially reduce, if not completely eliminate, infection the following season. The effective control to be gained from this practice for Botrytis blight and many other diseases of the peony cannot be emphasized too much.

The following spring, all rotted or wilting shoots should be removed and destroyed as soon as detected. It is also advisable to remove infected leaves and buds in the same manner. If a mulch has been used for winter protection, the covering should be removed early in the spring, to prevent damp conditions around the young shoots. One or two applications of bordeaux spray early in the season have been suggested by some workers. In general, however, the results obtained with sprays or dusts have not been satisfactory for the control of Botrytis blight.

Certain cultural practices will also prove beneficial. Thus, when making new plantings, the clumps should be given adequate space in order to prevent the development of large dense clusters which serve to promote conditions favorable to attacks of the fungus. For the same reason, old established plantings should be dug and divided when necessary. The use of sunny, open exposures will aid considerably in preventing serious epidemics of the Botrytis blight disease.

Field observations indicate that peony varieties vary widely with regard to relative susceptibility to the disease. Whenever possible, resistant varieties should be selected and used for establishing new plantings.

Phytophthora blight

Phytophthora blight, while more virulent than Botrytis blight, is fortunately not so widespread or prevalent. It is only during periods of prolonged wet weather that Phytophthora blight becomes generally and seriously destructive.

Symptoms

In many respects, the symptoms characteristic of this disease are similar to those of Botrytis blight. Stems, leaves, and buds are affected and in some cases the infection may extend down into the crowns of the plants. In general, the diseased tissues resulting from Phytophthora blight are dark brown to black in color and develop a tough or leathery texture in contrast with the lighter brown and softer rot which is typical of Botrytis blight. With Phytophthora blight, infection frequently starts at the tips of the branches and extends downward. On the leaves, the lesions are black in color with concentric markings.

Cause

Phytophthora blight is caused by the fungus *Phytophthora paeoniae* Cooper and Porter. Although but little is known about the life history of this fungus, it seems probable that the pathogene overwinters on infested plant parts and is disseminated from plant to plant in the growing season by means of spores which are splashed or washed about during the course of heavy rains.

Control

The measures suggested above for the control of Botrytis blight are equally effective for Phytophthora blight. The use of bordeaux spray offers more promise for Phytophthora than for Botrytis blight. Applications should be started early in the spring and in the event of a wet season should be continued until the flower buds are well formed.

Root-knot

During the past few years, a disease known as root-knot has apparently become increasingly severe and prevalent on peonies. The disease is by no means confined solely to the peony. It has been reported on the roots of a large number of other plants including weeds, food crops, and ornamentals. Although widely distributed in the eastern United States, the disease is more severe in those regions having warm growing seasons and mild winters.

Symptoms

When affected with root-knot, peonies are markedly stunted, produce spindly short stems with small light colored leaves and form few or no flower buds. When removed from the soil it will be observed that the large fleshy roots are short and irregularly knotted or swollen. Numerous small galls of varying size and shape will be found on the feeding rootlets (figure 24).

Cause

Root-knot is caused by a miscroscopic, soil-inhabiting nematode (eelworm) known as *Heterodera marioni* (Cornu) Goodey. The nematodes gain entrance into the peony roots by piercing the tissues with the small spears in their head. The presence of nematodes within the roots excite the cells to abnormal enlargement and the typical knots or galls result. Such roots are unable to transfer water and nutrients from the soil and thus the vital physiological processes of the plants are seriously interfered with. Once introduced into an area on infected plant parts, the eelworms multiply rapidly and are disseminated by their own movements or by cultivation, running water, and other similar means. Eelworms overwinter in the soil or within infected roots.

Control

Although various methods have been suggested for the control of root-knot, it should be pointed out that the disease is a difficult problem with which to cope. For a small gardener, the simplest procedure is to destroy all infected peonies. Healthy plants should then be obtained and set out in nematode-free soil.

If large numbers of plants have become diseased, the hot-water treatment offers a possible means of control. The roots should be dug when the plants are dormant and should be allowed to dry for several hours. After the roots have been cleaned and divided into 3 to 5 eyes, the divisions should be given a pre-soak for 20 minutes in water heated to a temperature of 100° F. The roots should then be soaked for 30 minutes in water at a temperature of 120° F. If the temperature falls below 119° F., the nematodes will not be

FIGURE 24. GALLS ON PEONY ROOTS TYPICAL OF INFECTION WITH THE ROOT-KNOT NEMATODE

killed; and if it rises above 121° F., the roots will be injured. Thus, in order to be safe, growers should obtain special apparatus designed to give accurate control of the temperatures. After treatment, the roots should be cooled immediately in cold water.

Healthy or hot-water-treated roots should never be planted in nematode-infested soil. In fact, it is not safe to grow any susceptible crops in such soil for a period of at least two years. The reduction in nematode population can be hastened by leaving the land fallow or by growing non-susceptible crops in such areas. Among the crops suitable for this purpose are the Iron varieties of cowpeas, the broad beans, the coarse grasses, and most varieties of wheat.

Since root-knot is always more abundant on light sandy soils than on heavy clays, peonies should be planted in the heavier soils.

Stem rot

Stem rot is one of the less common diseases to which the peony is susceptible. With optimum environmental conditions, however, the disease can become exceedingly destructive, particularly after the plants attain full growth.

Symptoms

While peonies affected with stem rot exhibit many of the symptoms described for the Botrytis or Phytophthora blights, the disease can be distinguished by the presence under some conditions of a white mouldy growth on the affected plant parts, and more particularly by the large black sclerotia which are formed in the centers of the diseased stems.

Cause

Stem rot is caused by the soil-inhabiting fungus *Sclerotinia sclerotiorum* (Lib.) DeBary. This fungus attacks a considerable number of plants, vegetables as well as ornamentals, and is therefore likely to be introduced into a garden through the practice of mulching with various kinds of litter.

Control

Sanitation should receive special attention in the control of stem rot. The removal and destruction of all plant debris will aid materially in reducing the number of sclerotia by means of which the fungus overwinters or is disseminated from place to place. In severe infections, the affected plants should be dug up and burned. When the infection is less severe, it will sometimes pay the grower to cut away the diseased portions and reset the plants in a new location in soil free from the causal fungus. In gardens where stem rot has been a problem, it is always advisable to keep manure away from the crowns of the plants.

Verticillium wilt

Generally speaking, Verticillium wilt is not a common disease of the peony. Reports of its presence, however, are received from time to time, and at least two species of fungi belonging to the genus Verticillium have been obtained from infected plants. Plants attacked by the causal fungus gradually wilt and then die. External symptoms in the form of lesions and the like are lacking with this disease. In cross or longitudinal section, however, the infected stems or roots exhibit a characteristic discoloration of the water-conducting tissues.

Since the fungus is perennial in the roots, any attempt to save infected plants is useless. Diseased individuals should be removed promptly and destroyed by burning. Before replanting the same area with healthy peonies, it would also be advisable to change the soil.

Blotch, anthracnose, and leafspots

Peonies are commonly attacked by various fungi that cause blotch, anthracnose, leafspot, and similar diseases. Since control measures are the same for all, these maladies are treated in one group.

Symptoms

The diseases are characterized in general by foliage lesions that vary in size, shape, and color, depending upon the causal organism involved. In some of these maladies, definite lesions similar in appearance to those on the leaves may occur on the stems as well. With most of these troubles, the lesions are round in shape (figure 25) and vary in color from gray-white to reddish brown or purple. Although infections do not kill the plants, continued attacks cause a general weakening of the peonies with a consequent reduction in flower production. The presence of numerous lesions on the leaves also detracts from the ornamental value of the plants or flowers.

Cause

Blotch, anthracnose, and the various leafspots are caused by fungi belonging to the genera Cladosporium, Septoria, Cercospora, Phyllosticta, and Alternaria. These pathogenes overwinter on the stems and leaves of peonies infected during the previous growing season. Spores produced on affected plant parts are disseminated to near-by healthy plants by splashing rain or air currents.

Control

All of these diseases can usually be kept under control by the removal and destruction of dead plant debris in the fall. This practice aids in preventing the fungus from overwintering and serves to reduce the amount of inoculum available for infection the following season. If, during wet seasons,

FIGURE 25. LEAFSPOTS CHARACTERISTIC OF PEONY ANTHRACNOSE

the disease becomes too prevalent or serious, additional control can be obtained by several applications of bordeaux spray. Wider spacing of the plants to promote free circulation of the air and avoidance of shady situations will aid considerably in preventing further trouble.

Virus diseases

In addition to the various fungous diseases described, peonies are also subject to a number of troubles characterized by poor vigor, visible stunting of the plants, and a marked reduction in flower production. Some and possibly all of these maladies are caused by unknown entities termed *viruses*. Certain of the more common maladies have been the subjects of brief investigations, while others have hardly been described.

Thus, mosaic is a virus disease distinct from the others in that the foliage

of affected plants exhibits distinct chlorotic areas which occur in concentric rings (figure 26). Spread of the disease is relatively slow, and the mode of dissemination is unknown.

Crown elongation is another disease of the peony which, because of its symptoms and seasonal development under field conditions, is caused probably by a virus. Marked elongation and proliferation of the crowns

FIGURE 26. PEONY MOSAIC
Note the concentric dark and light green areas

FIGURE 27. AUTUMN CONDITION OF PEONY PLANT AFFECTED WITH CROWN ELONGATION

(figure 27) with weak shoots, dwarfed foliage, and no buds are symptoms characteristic of the trouble.

The Lemoine disease, for want of a better place, can also be included with the possible virus diseases. The symptoms are rather similar to those described for root-knot but nematodes have never been found in the root galls. In consideration of the symptoms and with definite evidence that the disease is infectious, it is probable that here also the pathogene may be an unknown virus.

With all of these diseases, there are no cases on record in which it has been proved that affected plants have been cured or have recovered naturally. For this reason, and until further information is forthcoming, the safest course to pursue would be to remove and destroy infected plants as soon as they are detected, thus to avoid further spread of the troubles through divisions or possible insect vectors.

INSECT PESTS

GRACE H. GRISWOLD

Peonies are comparatively free from the attacks of insects. Only a few species of insects appear to feed on this popular garden plant, and of these not all cause real injury.

The rose chafer

The rose chafer, or rose beetle (*Macrodactylus subspinosus* Fab.), is widely distributed in New York State, occurring more commonly in regions where the soil is somewhat sandy. The adult (figure 28) is a grayish tan beetle slightly less than one-half inch in length. It has long slender reddish brown legs which are covered with spines. These beetles sometimes occur in enormous numbers during the month of June and cause serious damage to peonies and roses. The beetles feed mostly on the flowers, eating large holes in the petals and even destroying entire blossoms. It is said that the late-flowering varieties of peonies are more apt to be injured. If this is true, it might be wise to grow principally early-blooming varieties in those localities where the beetles are likely to be numerous.

FIGURE 28. THE ROSE CHAFER

Control

The rose chafer is a very active insect and difficult to control. Probably as good a method as any is to pick or jar the insects from the plant and drop them into a pan of kerosene. Choice plants may be protected by covering them with wire netting or cheesecloth. A spray which has been used with considerable success to control the rose chafer on grapes might be effective on peonies. It consists of the following ingredients: 1 ounce of lead arsenate, 1/3 cup of molasses, and 1 gallon of water. The spray should be applied when the beetles first appear. If necessary, a second application may be made a week later. Spraying should not be done just before a rain. Pyrethrum would undoubtedly check the beetles and might be more convenient to use on peonies in a home garden than would arsenic and molasses. Solutions of pyrethrum are now available commercially under various trade names. In using such solutions, one should follow the directions given by the manufacturer.

The rose curculio

Another beetle which sometimes injures late-blooming peonies is the rose curculio (*Rhynchites bicolor* Fab.). The adult (figure 29) is about 1/4 of an inch in length and its mouthparts are at the end of a long black snout. The body is black underneath, but on the upper surface it is bright red; hence the beetle, in spite of its small size, is quite conspicuous as it crawls about. With its long snout, the beetle gnaws deep holes in the flower buds of peonies and roses. Some of these buds fail to open, while those that do open are riddled with holes. The beetles are most abundant during June and early July. Eggs are laid in the hips (fruiting bodies) of roses, principally of *Rosa rugosa*.

FIGURE 29. THE ROSE CURCULIO ON ROSA RUGOSA

When the eggs hatch, the larvae feed upon the seeds. Early in September the larvae leave the rose hips and drop to the ground. Here they burrow from 1½ to 4 inches below the surface, eventually pupate, and emerge the following summer. There is only one generation a year.

Control

As with the rose chafer, the simplest method of control is to pick or shake the rose curculios from the plant and drop them into a pan of kero-

sene. When the beetles are disturbed, they are likely to fall to the ground and feign death. It will, therefore, be necessary to go over the plants several times a day in order to get all of the insects. Peonies may be sprayed with the following mixture: 1 ounce of lead arsenate, ¼ ounce of casein, and 1 gallon of water. If casein is not available, a tablespoonful of sour milk may be used instead. Another good spray consists of 1 ounce of white hellebore and 3 gallons of water. Since this spray is practically colorless, it might be more satisfactory than the lead arsenate for peonies. Collecting and burning all rose hips, especially those of *Rosa rugosa,* will destroy many larvae and hence reduce the number of beetles that would otherwise emerge the following summer. Cultivating the ground around rose bushes late in the fall and early in the spring will also help to reduce the number of curculios.

Ants

Probably no insects that occur on peonies are more annoying than ants. So far as known, common ants cause no direct injury to peonies, they simply feed on the sweet secretions that exude from the flower buds. It has been said, however, that ants act as carriers of one of the peony diseases (see page 33).

Control

The only really satisfactory way to combat ants is to locate the nest or colony and to apply the treatment there. One of the best insecticides to use is carbon bisulfide. With a sharpened stick, several holes should be made in the ant hill, and into each hole should be poured about one tablespoonful of carbon bisulfide. The mouth of each hole is then quickly closed with a clod of dirt, pressed down with a trowel or the toe of one's shoe. If wet newspapers, held down by bricks or stones, are placed over the hill, the fumigation will be more effective. The carbon bisulfide evaporates quickly and the gas penetrates the whole nest, killing the queen and the workers and so exterminating the entire colony. In order to prevent any possibility of injury to the plants, the punched holes should be at least eight inches from the roots of the plants. The treatment should be applied at dusk, for at this time all the ants will have returned to the nest for the night.

In the use of carbon bisulfide, it must be remembered that the gas is inflammable and explosive, and no form of fire or light should be brought near the place that is being fumigated.

Calcium cyanide also has been used with marked effect against out-door ants. It can be bought in a form known commercially as the G-grade, which is like fine sand. It is a *deadly poison* and should be handled with great care. Fowls and other domestic animals should be kept away from the treated ants' nests because of the danger from the poison. If the granules are scattered over an ant hill after the hill has been stirred on the surface,

the ants will begin immediately to remove the tiny grains, and every ant that touches the cyanide will be killed. Colonies can be practically exterminated in this way. The material is now available in convenient four-ounce tin cans. Since each can is provided with a short spout, the cyanide can be evenly and economically distributed over the surface of the ant hill.

PEONY BREEDING

A. M. S. PRIDHAM

Many varieties of peonies (*P. albiflora*) set seed freely in the garden without any special treatment. The gardener is often tempted to save and to plant these chance seed with the hope that he may obtain new and improved varieties. It is true that a small proportion of such seedlings will be of equal merit to the average variety and a few are even better. Many varieties have originated in this way. For most gardeners it is a triumph to obtain any seedlings at all as a reward for their efforts.

Generally speaking, only a small proportion of the seeds will germinate and those very slowly. The growth of the young plants is likewise slow, so it may be from four to six years after the seed has been planted before the first blooms open. The character of these young plants sometimes changes as they grow older, and it will take another few years for the gardener to know the exact qualities of his seedlings.

The plant breeder is not so much interested in chance seedlings as in obtaining seed from selected parent plants which are likely to produce desirable new types. In order to accomplish this, the blooms must be protected from undesirable pollen by emasculation and by covering. It is necessary also to obtain sufficient pollen of the desired sort (parent) and at the correct time. Many breeders gather the pollen on a knife blade or on the finger nail and apply the pollen directly to the stigma rather than using a camel's-hair brush, which they claim is inefficient and wasteful.

Crosses which include the use of peony species are especially difficult to make. Crosses of the varieties of garden peony (albiflora) with those of the early-flowering *tenuifolia* are examples of this type. When varieties of the *lobata* group rather than the *tenuifolia* group are used, the cross is easily made. The yellow peony *P. mlokosewitchii* is a particularly tempting one to the plant breeder. It has been found to cross readily with *P. tenuifolia* but is difficult, if not impossible, to use with the *albiflora* varieties among which the introduction of yellow color is so much sought.

Dr. A. P. Saunders, of Clinton, New York, has been engaged in peony breeding as a hobby for some twenty-five years and has succeeded in making a large number of crosses. Dr. Saunders has found the majority of hybrids to be sterile. This makes it impossible to carry the cross through the second

generation which is so important to obtain new combinations of desirable characters; for example, to combine in one individual the yellow color of one parent with the form of the other parent.

The species crosses which Dr. Saunders has succeeded in carrying through to the second generation through selfed first generation plants are the following: *P. albiflora* with *P. macrophylla,* with *P. lobata* var. Otto Froebel, with *P. officinalis; P. lobata* var. Otto Froebel with *P. macrophylla; P. officinalis* with *P. lobata* var. Otto Froebel and with *P. macrophylla; P. Woodwardii* with *P. tenuifolia.*

Back crosses and outcrosses have been obtained: *P. albiflora* x *P. macrophylla* on *P. albiflora; P. lobata* var. Otto Froebel x *P. macrophylla* on *P. albiflora; P. officinalis* x *P. macrophylla* on *P. albiflora; P. lobata* var. Otto Froebel x *P. macrophylla* on *P. lobata* var. Otto Froebel also on *P. macrophylla; P. officinalis* x *P. macrophylla* on both *P. officinalis* and on *P. macrophylla; P. lobata* var. Otto Froebel x *P. macrophylla* on *P. officinalis* and on *P. Wittmanniana.*

The chromosome numbers as reported by Langlet for the species mentioned are as follows: Haploid number five, *P. albiflora;* Haploid number ten, *P. officinalis, P. officinalis* var *lobata, P. macrophylla,* and *P. Wittmanniana.*

As a result of recent experimental work Lela V. Barton suggests that peony seed be planted in a warm greenhouse immediately after harvest and be allowed to remain for three months or until root production is complete. The young plants should then be removed to a cool room where the temperature may be maintained between 40° and 55° F. Under these conditions top growth will commence, and after two or three months the plants are ready to be removed to a greenhouse where the temperature will be kept at 50° to 55° F., or the plants may be set in a cold frame.

If the grower has no greenhouse and the seed must be kept until spring, cold frames will be of service. The seed is planted in May and the soil is kept moist during the summer. Shade and winter protection may be provided with a lath screen or by a few boards. As the young plants grow, the shade may be removed and the plants set out in the nursery row.

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